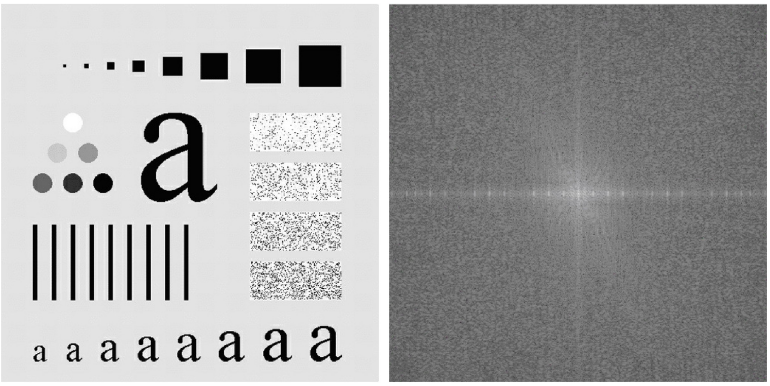
Tutorial 5

Problem 5.1



A test image (left) and its amplitude spectrum with logarithmic scaling (right) is given. Where do the almost periodic bright dots on the frequency axis come from?

Problem 5.2

a) An image is described by the bivariate function $s(x, y)$. What are the conditions for separability of $s(x, y)$?

b) How does separability generally translate to the Fourier transform of multi-dimensional signals $s(\vec{x})$?

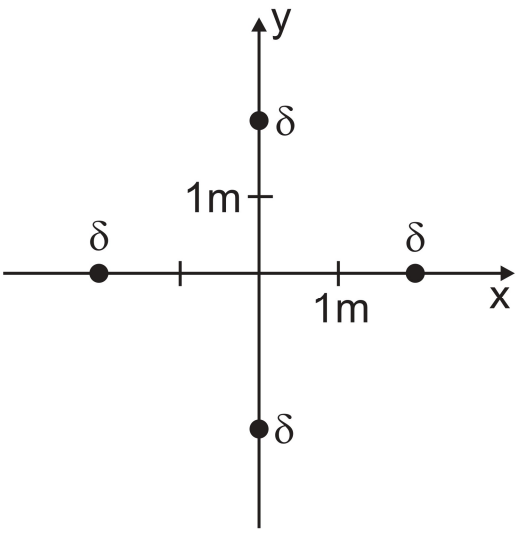
c) The Dirac impuls is known from one-dimensional system theory. The concept of the impulse can be generalized for two-dimensional signals. In 2D, it is possible to define a δ-line. Describe the δ-line and determine its spectrum.

d) In 3D, a δ plane can be specified. Compute the 3D Fourier transform of a δ plane.

e) Compute the 2D Fourier transform of $s(x, y) = \delta(x) \sum_{n=-\infty}^{\infty} \delta(y - n)$

f) Compute the 2D Fourier transform of $s(x, y) = \cos(2\pi y)\delta(x)$.

Problem 5.3



An image defined by four δ impulses is given.

a) Sketch the spectrum and mark the frequency $f_x = 0,5\,m^{-1}$.

b) Sketch the Fourier transform $S(f_x, f_y)$ for $f_y = 0$.

